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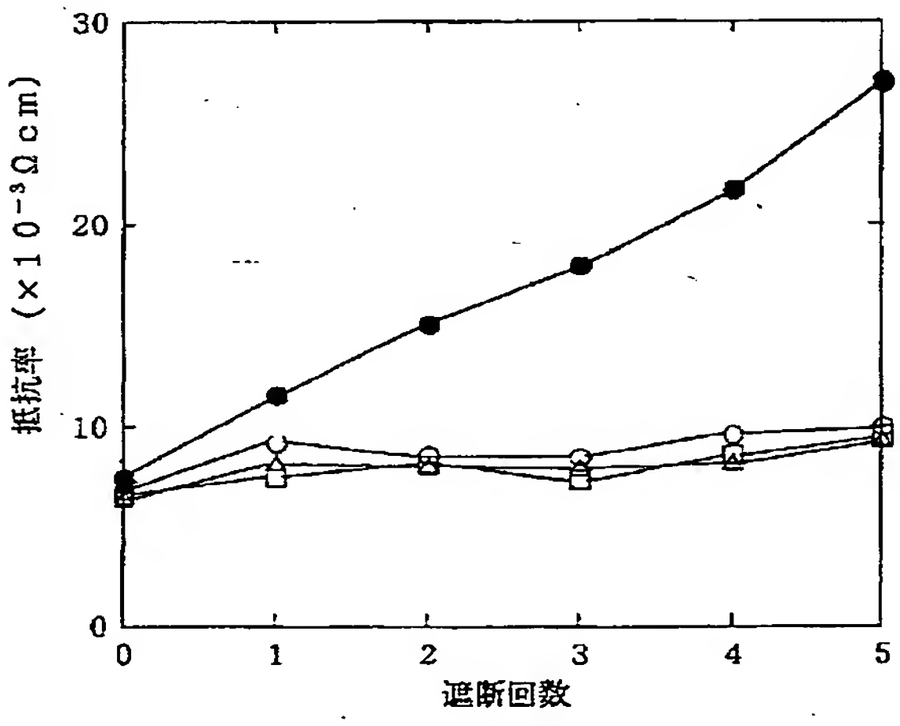
(54)【発明の名称】　ＰＴＣ抵抗体の製造方法およびそれを含む開閉器

(57)【要約】
【課題】　耐熱衝撃性に優れ、大電流通電の繰り返し使用可能なPTC抵抗体の製造方法およびこれにより得られるPTC抵抗体を備えた小型化の達成可能な開閉器を提供すること。
【解決手段】　主成分がV_2O_3である仮焼粉末を、所望の形状に一軸加圧成形する工程と、得られた一軸加圧成形体を等方圧縮する工程と、続いて得られた等方圧縮成形体を本焼成する工程とを有するPTC抵抗体の製造方法と、これにより得られるPTC抵抗体を備えた開閉器。



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【特許請求の範囲】
【請求項１】　主成分がV_2O_3である仮焼粉末を、所望の形状に一軸加圧成形する工程と、得られた一軸加圧成形体を等方圧縮する工程と、続いて得られた等方圧縮成形体を本焼成する工程とを有するPTC抵抗体の製造方法。
【請求項２】　等方圧縮の圧力が、仮焼粉末の一軸加圧成形圧力以上であることを特徴とする請求項１記載のPTC抵抗体の製造方法。
【請求項３】　請求項１または２に記載の製造方法によって製造されたPTC抵抗体を備えることを特徴とする開閉器。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明はPTC抵抗体の製造方法およびこれにより得られたPTC抵抗体を含む開閉器に関するものである。
【０００２】
【従来の技術】近年、大きなPTC特性を示す物質である酸化バナジウム(V_2O_3)を用いたPTC抵抗体を低圧遮断器の限流素子として実用化する試みが行われている。酸化バナジウム(V_2O_3)は常温で数ミリオームセンチの低い抵抗率を示すが、約100℃で抵抗率が急激に増大して100ミリオームセンチ前後の高い抵抗率を示すことが知られている。このような大きなPTC特性はサーミスタとして利用されているが、近年では、短絡電流を遮断する開閉器の遮断動作を助ける限流素子として酸化バナジウム(V_2O_3)を適用することも試みられている。従来、常温での比抵抗の低減や耐熱衝撃性の向上の目的で、酸化バナジウム(V_2O_3)のバナジウムイオンの一部を他の元素で置換したり、金属元素を添加することが試みられている。
【０００３】
【発明が解決しようとする課題】PTC抵抗体は通電時に電力損を生じている。また、開閉器などに組み込まれ、短絡電流の遮断に繰り返し使用する場合、繰り返し熱衝撃を受ける。
【０００４】PTC抵抗体を限流素子として短絡電流遮断回路に用いる場合、電力損を小さくするためには常温での抵抗値が小さいことが必要である。しかし従来法によって製造されたPTC抵抗体は、耐熱衝撃性が低いために短絡電流印加時の熱衝撃によってクラックが生じるという問題点があった。これが原因となって、従来法によって製造したPTC抵抗体は、限流素子として繰り返し使用すると常温抵抗値が増大して電力損失が増加するという問題があった。そこで、繰り返し使用しても常温抵抗値が増加しないような、耐熱衝撃性の高いPTC抵抗体の開発が希求されていた。
【０００５】したがって本発明の目的は、耐熱衝撃性に優れ、大電流通電の繰り返し使用可能なPTC抵抗体の製造方法およびこれにより得られるPTC抵抗体を備えた小型化の達成可能な開閉器を提供することにある。

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【０００６】
【課題を解決するための手段】請求項１の発明は、主成分がV_2O_3である仮焼粉末を、所望の形状に一軸加圧成形する工程と、得られた一軸加圧成形体を等方圧縮する工程と、続いて得られた等方圧縮成形体を本焼成する工程とを有するPTC抵抗体の製造方法である。請求項２の発明は、等方圧縮の圧力が、仮焼粉末の一軸加圧成形圧力以上であることを特徴とする請求項１記載のPTC抵抗体の製造方法である。請求項３の発明は、請求項１または２に記載の製造方法によって製造されたPTC抵抗体を備えることを特徴とする開閉器である。
【０００７】従来法で得られた仮焼粉末の成形体に、本発明の特徴である等方圧縮工程を加えることにより、本発明によって製造されたPTC抵抗体は高緻密化するという効果を付与される。そのため、本発明によって製造されたPTC抵抗体は、高い耐熱衝撃性を示すという作用がある。またこの作用により、本発明によって製造されたPTC抵抗体は、限流素子として大電流通電の繰り返し使用が可能となる耐久性を有する。なお本発明でいう等方圧縮とは、一軸加圧成形体の全体に対し、等しい圧力がその周囲に施されることを意味する。
【０００８】
【発明の実施の形態】実施の形態１．V_2O_3 49.750gとCr_2O_3 0.250gおよび金属Ni粉末2.500gを秤量し乾式混合した後、成形し3%H_2を含むAr/H_2気流中1200℃で1.5時間仮焼を行った。これを湿式ボールミル中にて微粉砕を行い乾燥後バインダーを加え造粒し、これを金型にて2000kgf/cm^2の圧力で一軸加圧成形し、この一軸加圧成形体に本発明の特徴である等方圧縮を施した。この等方圧縮は、ラバープレス機を用いて行った。すなわちゴム製の袋体にサンプルを入れ、その周囲を水圧でもって均一に圧縮するものである。等方圧縮における圧力は2000kgf/cm^2とした。得られた等方圧縮成形体を1%H_2を含むAr/H_2気流中で１５００℃で焼成し、断面7mm×11mm長さ20mmの試料を得た。なお、この本焼成の温度は原料組成等を勘案して適宜決定すればよい。得られた焼成体にIn-Ga電極を形成し、図１に示すようにして開閉器の一部と成した。図１において、１は限流ユニット筐体、２は電源側端子、３は限流ユニット内部、４はPTC低抗体、５は固定接触子、６は可動接触子、７はグリッド、８は取っ手、９は開閉機構、１０は遮断器筐体、１１は遮断器、１２は負荷側端子である。これを図２に示した遮断試験回路に組んで300V，50kAの交流半波電流を短絡電流として繰り返し印加し遮断試験を行った。なお、図２において１３は開閉器、１４は遮断機構、Ｉｕは回路電流、Ｉｖは素子電流、Ｖｖは素子電圧、Ｖｕは全電圧である。結果を図３に示す。遮断試験前の室温抵抗率は6.8×10^{-3} Ω cmで遮断試験５回後の室温抵抗率は9.9×10^{-3} Ω cmとなり、その増加はわずか1.5倍にとどまった。
【０００９】実施の形態２．V_2O_3 49.750gとCr_2O_3 0.25

0gおよび金属Ni粉末2.500gを秤量し乾式混合した後、成形し3%H_2を含むAr/H_2気流中1200℃で1.5時間仮焼を行った。これを湿式ボールミル中にて微粉砕を行い乾燥後バインダーを加え造粒し、これを金型にて2000kgf/cm^2の圧力で一軸加圧成形し、この一軸加圧成形体に本発明の特徴である等方圧縮を施した（実施の形態１．と同じラバープレス機を用いた）。等方圧縮における圧力は4000 kgf/cm^2とした。得られた等方圧縮成形体を1%H_2を含むAr/H_2気流中で１５００℃で焼成し、断面7mm×11mm長さ20mm試料を得た。この焼成体にIn-Ga電極を形成し、図１に示すようにして開閉器の一部と成した。これを図２に示した遮断試験回路に組んで300V，50kAの交流半波電流を短絡電流として繰り返し印加し遮断試験を行った。結果を図３に示す。遮断試験前の室温抵抗率は6.3×10^{-3} Ωcmで遮断試験５回後の室温抵抗率は9.2×10^{-3} Ωcmとなり、その増加はわずか1.5倍にとどまった。

【００１０】実施の形態３．V_2O_3 49.750gとCr_2O_3 0.250gおよび金属Ni粉末2.500gを秤量し乾式混合した後、成形し3%H_2を含むAr/H_2気流中1200℃で1.5時間仮焼を行った。これを湿式ボールミル中にて微粉砕を行い乾燥後バインダーを加え造粒し、これを金型にて2000Kgf/cm^2の圧力で一軸加圧成形し、この一軸加圧成形体に本発明の特徴である等方圧縮を施した（実施の形態１．と同じラバープレス機を用いた）。等方圧縮における圧力は7000 kgf/cm^2とした。得られた等方圧縮成形体を1%H_2を含むAr/H_2気流中で１５００℃で焼成し、断面7mm×11mm長さ20mm試料を得た。この焼成体にIn-Ga電極を形成し、図１に示すようにして開閉器の一部と成した。これを図２に示した遮断試験回路に組んで300V，50kAの交流半波電流を短絡電流として繰り返し印加し遮断試験を行った。結果を図３に示す。遮断試験前の室温抵抗率は6.6×10^{-3} Ωcmで遮断試験５回後の室温抵抗率は9.5×10^{-3} Ωcmとなり、その増加はわずか1.4倍にとどまった。

【００１１】比較例１．V_2O_3 49.750gとCr_2O_3 0.250gおよび金属Ni粉末2.500gを秤量し乾式混合した後、成形し3%H_2を含むAr気流中1200℃で1.5時間仮焼を行った。これを湿式ボールミル中にて微粉砕を行い乾燥後バインダーを加え造粒し、これを金型にて2000kgf/cm^2の圧力で一軸加圧成形し、得られた一軸加圧成形体を1%H_2を含むAr/H_2気流中で１５００℃で焼成し、断面7mm×11mm長さ20mm試料を得た。この焼成体にIn-Ga電極を形成し、図１に示すようにして開閉器の一部と成した。これを図２に示した遮断試験回路に組んで300V，50kAの交流半波電流を短絡電流として繰り返し印加し遮断試験を行った。結果を図３に示す。遮断試験前の室温抵抗率は7.5×10^{-3} Ωcmで遮断試験５回後の室温抵抗率は27.0×10^{-3} Ωcmとなり、その増加は3.6倍にも達した。

【００１２】上記実施の形態および比較例において遮断試験に用いた開閉器本体の規格は、常温抵抗値を26mΩ以下と定めている。上記実施例１、２、３におけるPTC抵抗体は、遮断試験を５回行った後でもその常温抵抗値はすべて上記規格を満たした。したがって、等方圧縮工程を含むことを特徴とする本発明の製造方法によって製造されたPTC抵抗体は、５回を上限として、実用上問題なく繰り返し使用できる。

【００１３】一方上記比較例１．におけるPTC抵抗体は遮断試験１回後に、それぞれ開閉器本体の規格値26mΩを超えた。したがって従来法によって製造された上記比較例１．におけるPTC抵抗体は短絡電流を限流する目的では実用に耐えない。

【００１４】上記実施の形態３．においては等方圧縮圧力として最大7000kgf/cm^2を用いたが、これは現在商業目的で適用可能なラバープレス機の最大能力である。将来これ以上の能力を有するラバープレス機が商業目的に適用可能となれば、7000kgf/cm^2以上の等方圧縮圧力を成形体に印加することによって本実施の形態と同様の効果を得られることはいうまでもない。

【００１５】本明細書の実施の形態においては等方圧縮の手法として、いわゆるラバープレス法を用いた。しかし本発明においては、金型中にて一軸加圧した成形体に、さらに等方的に圧力を印加することが特徴である。したがって等方的に圧力を印加できる手法であれば必ずしもラバープレス法に限る必要はなく、また、冷間である必要もないことはいうまでもない。

【００１６】

【発明の効果】請求項１の発明によれば、主成分がV_2O_3である仮焼粉末を、所望の形状に一軸加圧成形する工程と、得られた一軸加圧成形体を等方圧縮する工程と、続いて得られた等方圧縮成形体を本焼成する工程とを有するので、PTC抵抗体の耐熱衝撃性が向上し、繰り返し使用時の常温比抵抗値の上昇が低減され、通電時の電力損失も低減され、なおかつ大電流通電の繰り返し使用可能になるPTC抵抗体が得られる。

【００１７】請求項２の発明によれば、等方圧縮の圧力が、仮焼粉末の一軸加圧成形圧力以上に設定したので、PTC抵抗体の耐熱衝撃性が一層向上する。

【００１８】請求項３の発明によれば、開閉器が請求項１または２に記載のPTC抵抗体の製造方法によって製造されたPTC抵抗体を備えているので、高性能化および小型化が達成される。

【図面の簡単な説明】

【図１】　PTC抵抗体を含む開閉器を示す図である。

【図２】　遮断試験回路を示す回路図である。

【図３】　本発明によるPTC抵抗体の特性を説明するためのグラフである。

【符号の説明】

１　限流ユニット筐体、２　電源側端子、３　限流ユニット内部、４　PTC低抗体、５　固定接触子、６　可動接触子、７　グリッド、８　取っ手、９　開閉機構、１０　遮断器筐体、１１　遮断器、１２　負荷側端子、１

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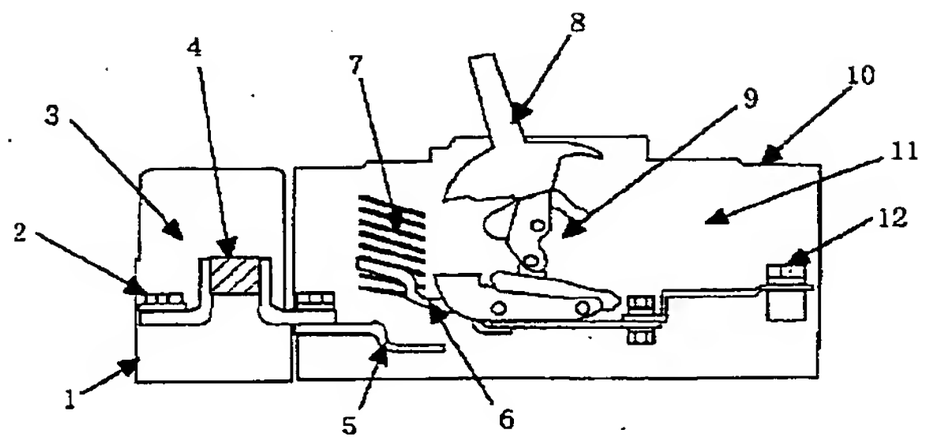
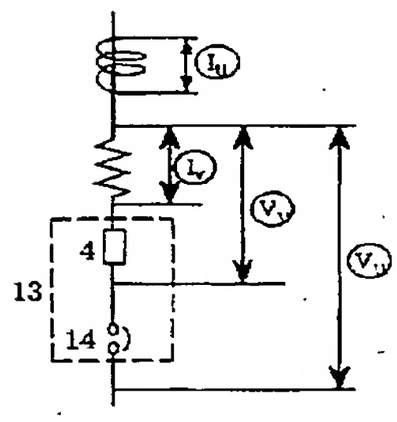
３　開閉器、１４　遮断機構。

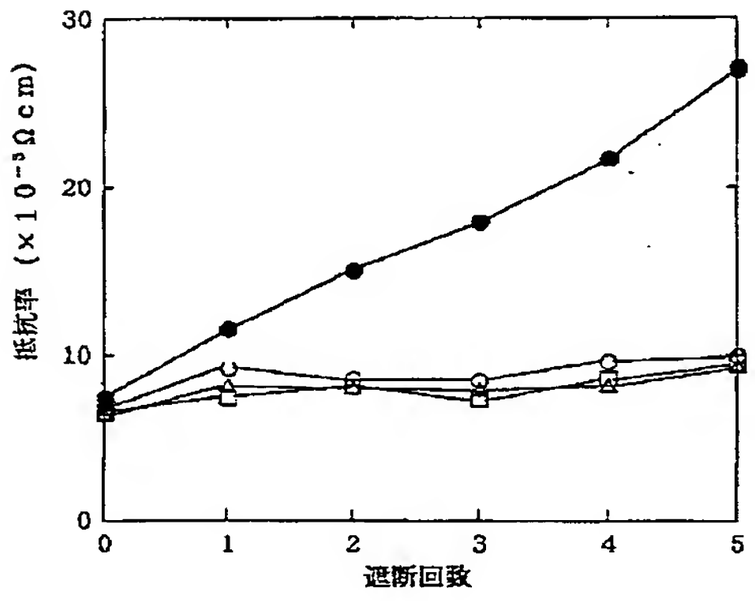
【図１】



【図２】



【図３】



○：実施の形態１．
△：実施の形態２．
□：実施の形態３．
●：比較例１．

フロントページの続き

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(54) MANUFACTURE OF PTC RESISTOR BODY AND SWITCH INCLUDING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a product superior in heat resistance and shock resistance and enable the repetitive use for flowing high currents by uniaxially pressure-forming a calcined powder containing V oxide as a main component into a desired shape, isotropically compressing the obtained uniaxially pressure-formed compact and regularly sintering it.
SOLUTION: After dry mixing a main component V2O3 with Cr2O3 and metal Ni powder, a compact is formed, calcined in a gas flow of Ar/H2, pulverized in a wet ball mill, dried and granulated with an added binder, the powder is uniaxially pressure-formed at a pressure of about 2000 kgf/cm2, the molding is isotropically compressed, using a rubber press, i.e., the sample is put in a rubber bag and its periphery is isotropically compressed uniformly with a water pressure of about 2000 kgf/cm2 or more, and the obtd. isotropically compressed molding is baked in a gas flow of Ar/H2 to obtain a sintered body.

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CLAIMS

[Claim(s)]
[Claim 1] The manufacture approach of the PTC resistor which has the process which carries out 1 shaft pressing of the temporary-quenching powder whose principal component is V2O3 to a desired configuration, the process compressed directions [object / which was acquired / 1 shaft pressing], and the process which carries out actual baking of the direction compression-molding object, such as having been obtained continuously.
[Claim 2] The manufacture approach of a PTC resistor according to claim 1 that the pressure of **** compression is characterized by being more than the 1 shaft pressing pressure of temporary-quenching powder.
[Claim 3] The switch characterized by having the PTC resistor manufactured by the manufacture approach according to claim 1 or 2.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the switch containing the manufacture approach of a PTC resistor, and the PTC resistor obtained by this.
[0002]
[Description of the Prior Art] In recent years, the attempt which puts in practical use the PTC resistor using the vanadium oxide (V2O3) which is the matter in which a big PTC property is shown as a ** style component of a low voltage breaker is performed. Although a vanadium oxide (V2O3) shows the low resistivity of a number milli-ohm centimeter in ordinary temperature, it is known that resistivity increases rapidly at about 100 degrees C, and the high resistivity before and behind 100 milli-ohm centimeters is shown. Although such a big PTC property is used as a thermistor, in recent years, to apply a vanadium oxide (V2O3) as a ** style component which helps cutoff actuation of the switch which intercepts a short-circuit current is also tried. Conventionally, for reduction of the specific resistance in ordinary temperature, or the object of improvement in thermal shock resistance, other elements permute some vanadium ion of a vanadium oxide (V2O3), or to add a metallic element is tried.
[0003]
[Problem(s) to be Solved by the Invention] The PTC resistor has produced power dissiption at the time of energization. Moreover, when it is included in a switch etc. and uses it for cutoff of a short-circuit current repeatedly, a repeat thermal shock is received.
[0004] When using for a short-circuit current cutoff circuit by using a PTC resistor as a ** style component, in order to make power dissiption small, it is required for the resistance in ordinary temperature to be small. However, since the PTC resistor manufactured by the conventional method had low thermal shock resistance, it had the trouble that a crack arose by the thermal shock at the time of short-circuit current impression. When the PTC resistor manufactured with the conventional method by this becoming a cause was repeatedly used as a ** style component, it had the problem that ordinary temperature resistance increased and power loss increased. Then, desire of the development of a PTC resistor with high thermal shock resistance which ordinary temperature resistance does not increase even if it uses it repeatedly was carried out.
[0005] Therefore, the object of this invention is excellent in thermal shock resistance, and is to offer the switch with which high current energization was repeatedly equipped with the manufacture approach of an usable PTC resistor, and the PTC resistor obtained by this and which can attain a miniaturization.
[0006]
[Means for Solving the Problem] Invention of claim 1 is the manufacture approach of the PTC resistor which has the process which carries out 1 shaft pressing of the temporary-quenching powder whose principal component is V2O3 to a desired configuration, the process compressed directions [object / which was acquired / 1 shaft pressing], and the process which carries out actual baking of the direction compression-molding object, such as having been obtained continuously. Invention of claim 2 is the manufacture approach of a PTC resistor according to

claim 1 that the pressure of the method compression of ** is characterized by being more than the 1 shaft pressing pressure of temporary-quenching powder. Invention of claim 3 is a switch characterized by having the PTC resistor manufactured by the manufacture approach according to claim 1 or 2.

[0007] it is the description of this invention at the Plastic solid of the temporary-quenching powder obtained with the conventional method — etc. — the effectiveness of carrying out high eburnation is given to the PTC resistor manufactured by this invention by applying a direction pressing operation. Therefore, the PTC resistor manufactured by this invention has an operation that high thermal shock resistance is shown. Moreover, according to this operation, the PTC resistor manufactured by this invention has the endurance whose repeat activity of high current energization is attained as a ** style component. In addition, direction compression, such as saying by this invention, means that an equal pressure is given to the perimeter to the whole 1 shaft pressing object.

[0008]

[Embodiment of the Invention] After carrying out weighing capacity of gestalt 1.V2O3 49.750g, Cr2O3 0.250g, and 2.500g of metal nickel powder of operation and blending it dryly, temporary quenching was performed at 1200 degrees C for 1.5 hours among the Ar/H2 air current which fabricates and contains H2 3%. this is pulverized in a wet ball mill, the binder after desiccation is added and corned, 1 shaft pressing of this is carried out by the pressure of 2000 kgf/cm2 with metal mold, and it is the description of this invention at this 1 shaft pressing object — etc. — direction compression was performed. This method compression of ** was performed using the rubber press machine. That is, a sample is put into the bag body made of rubber, and it compresses that it is also at water pressure about the perimeter into homogeneity. The pressure in **** compression was made into 2000 kgf/cm2. A direction compression-molding object, such as having been obtained, was calcinated at 1500 degrees C in the Ar/H2 air current which contains H2 1%, and 7mm x11mm die-length a sample of 20mm of cross sections was obtained. In addition, the temperature of this baking of this takes a raw material presentation etc. into consideration, and should just determine it suitably. As the In-Ga electrode was formed in the acquired baking object and it was shown in drawing 1 , it accomplished with some switches. drawing 1 — setting -- 1 -- a ** style unit case and 2 -- a power-source side edge child and 3 -- the interior of a ** style unit, and 4 — a PTC resistor and 5 -- fixed contact and 6 — for a handle and 9, as for a breaker case and 11, a closing motion device and 10 are [a moving contact and 7 / a grid and 8 / a breaker and 12] load side edge children. It constructed in the blocking test circuit which showed this to drawing 2 , and the alternating current half wave current of 300V and 50 kA was repeated as a short-circuit current, and was impressed, and the blocking test was performed. In addition, for a breaker style and Iu, in drawing 2 , a circuit current and Iv are [13 / a switch and 14 / a component electrical potential difference and Vu of a component current and Vv] full voltage. A result is shown in drawing 3 . The room temperature resistivity after five blocking tests was set to 9.9x10-3ohmcm in 6.8x10-3ohmcm by the room temperature resistivity before a blocking test, and the increment remained only 1.5 times.

[0009] After carrying out weighing capacity of gestalt 2.V2O3 49.750g, Cr2O3 0.250g, and 2.500g of metal nickel powder of operation and blending it dryly, temporary quenching was performed at 1200 degrees C for 1.5 hours among the Ar/H2 air current which fabricates and contains H2 3%. this is pulverized in a wet ball mill, the binder after desiccation is added and corned, 1 shaft pressing of this is carried out by the pressure of 2000 kgf/cm2 with metal mold, and it is the description of this invention at this 1 shaft pressing object — etc. — direction compression was performed (the same rubber press machine as gestalt 1. of operation was used). The pressure in **** compression was made into 4000 kgf/cm2. A direction compression-molding object, such as having been obtained, was calcinated at 1500 degrees C in the Ar/H2 air current which contains H2 1%, and 7mm x11mm die-length a sample of 20mm of cross sections was obtained. As the In-Ga electrode was formed in this baking object and it was shown in drawing 1 , it accomplished with some switches. It constructed in the blocking test circuit which showed this to drawing 2 , and the alternating current half wave current of 300V and 50 kA was repeated as

a short-circuit current, and was impressed, and the blocking test was performed. A result is shown in drawing 3 . The room temperature resistivity after five blocking tests was set to 9.2x10-3ohmcm in 6.3x10-3ohmcm by the room temperature resistivity before a blocking test, and the increment remained only 1.5 times.

[0010] After carrying out weighing capacity of gestalt 3.V2O3 49.750g, Cr2O3 0.250g, and 2.500g of metal nickel powder of operation and blending it dryly, temporary quenching was performed at 1200 degrees C for 1.5 hours among the Ar/H2 air current which fabricates and contains H2 3%. this is pulverized in a wet ball mill, the binder after desiccation is added and corned, 1 shaft pressing of this is carried out by the pressure of 2000 Kgf/cm2 with metal mold, and it is the description of this invention at this 1 shaft pressing object -- etc. -- direction compression was performed (the same rubber press machine as gestalt 1. of operation was used). The pressure in **** compression was made into 7000 kgf/cm2. A direction compression-molding object, such as having been obtained, was calcinated at 1500 degrees C in the Ar/H2 air current which contains H2 1%, and 7mm x11mm die-length a sample of 20mm of cross sections was obtained. As the In-Ga electrode was formed in this baking object and it was shown in drawing 1 , it accomplished with some switches. It constructed in the blocking test circuit which showed this to drawing 2 , and the alternating current half wave current of 300V and 50 kA was repeated as a short-circuit current, and was impressed, and the blocking test was performed. A result is shown in drawing 3 . The room temperature resistivity after five blocking tests was set to 9.5x10-3ohmcm in 6.6x10-3ohmcm by the room temperature resistivity before a blocking test, and the increment remained only 1.4 times.

[0011] After carrying out weighing capacity of example of comparison 1.V2O3 49.750g, Cr2O3 0.250g, and the 2.500g of the metal nickel powder and blending it dryly, temporary quenching was performed at 1200 degrees C for 1.5 hours among Ar air current which fabricates and contains H2 3%. This was pulverized in the wet ball mill, the binder after desiccation was added and corned, 1 shaft pressing of this was carried out by the pressure of 2000 kgf/cm2 with metal mold, the acquired 1 shaft pressing object was calcinated at 1500 degrees C in the Ar/H2 air current which contains H2 1%, and 7mm x11mm die-length a sample of 20mm of cross sections was obtained. As the In-Ga electrode was formed in this baking object and it was shown in drawing 1 , it accomplished with some switches. It constructed in the blocking test circuit which showed this to drawing 2 , and the alternating current half wave current of 300V and 50 kA was repeated as a short-circuit current, and was impressed, and the blocking test was performed. A result is shown in drawing 3 . The room temperature resistivity after five blocking tests was set to 27.0x10-3ohmcm in 7.5x10-3ohmcm by the room temperature resistivity before a blocking test, and the increment reached also 3.6 times.

[0012] The specification of the body of a switch used for the blocking test in the gestalt and the example of a comparison of the above-mentioned implementation has determined ordinary temperature resistance as less than [26mohm]. Also after the PTC resistor in the above-mentioned examples 1, 2, and 3 performed the blocking test 5 times, the whole of the ordinary temperature resistance fulfilled the above-mentioned specification. Therefore, the PTC resistor manufactured by the manufacture approach of this invention characterized by including the method pressing operation of ** makes 5 times an upper limit, and can use them repeatedly practically satisfactory.

[0013] On the other hand, the PTC resistor in above-mentioned example of comparison 1. exceeded value-of-standard 26mohm of the body of a switch after one blocking test, respectively. Therefore, the PTC resistor in above-mentioned example of comparison 1. manufactured by the conventional method does not bear practical use in order to carry out the ** style of the short-circuit current.

[0014] Although a maximum of 7000 kgf/cm2 was used as a method compression pressure of ** in gestalt 3. of the above-mentioned implementation, this is the maximum capacity of a rubber press machine applicable for the current commercial object. If the rubber press machine which will have the capacity beyond this in the future becomes applicable to the commercial object, it cannot be overemphasized by impressing direction compression pressures, such as two or more 7000 kgf/cm, to a Plastic solid that the same effectiveness as the gestalt of this operation can

be acquired.
[0015] In the gestalt of operation of this description, the so-called rubber press method was used as the technique of the method compression of **. However, in this invention, it is the description to impress a pressure to the Plastic solid pressurized one shaft in metal mold still more nearly isotropic. Therefore, if it is the technique of the ability to impress a pressure isotropic, it is not necessary to necessarily restrict to the rubber press method and, and it cannot be overemphasized that it is not necessary to be between the colds.
[0016]
[Effect of the Invention] Since it has the process which carries out 1 shaft pressing of the temporary-quenching powder whose principal component is V2O3 to a desired configuration, the process compressed directions [object / which was acquired / 1 shaft pressing], and the process which carries out actual baking of the direction compression-molding object, such as having been obtained continuously, according to invention of claim 1 the thermal shock resistance of a PTC resistor improves, lifting of the ordinary temperature resistivity at the time of a repeat activity is reduced, and the power loss at the time of energization is also reduced -- having -- in addition -- and the repeat of high current energization -- the PTC resistor which becomes usable is obtained.
[0017] According to invention of claim 2, since the pressure of the method compression of ** set up more than the 1 shaft pressing pressure of temporary-quenching powder, the thermal shock resistance of a PTC resistor improves further.
[0018] Since the switch is equipped with the PTC resistor manufactured by the manufacture approach of a PTC resistor according to claim 1 or 2 according to invention of claim 3, high-performance-izing and a miniaturization are attained.

[Translation done.]

DESCRIPTION OF DRAWINGS

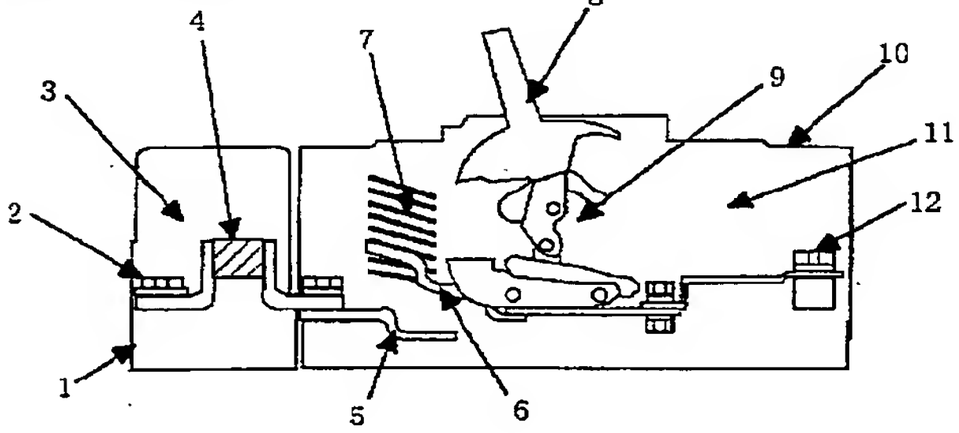
[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the switch containing a PTC resistor.
[Drawing 2] It is the circuit diagram showing a blocking test circuit.
[Drawing 3] It is a graph for explaining the property of the PTC resistor by this invention.

[Description of Notations]
1 A ** style unit case, 2 A power-source side edge child, 3 The interior of a ** style unit, 4 A PTC resistor, 5 Fixed contact, 6 A moving contact, 7 A grid, 8 A handle, 9 A closing motion device, 10 A breaker case, 11 A breaker, 12 A load side edge child, 13 A switch, 14 Breaker style.

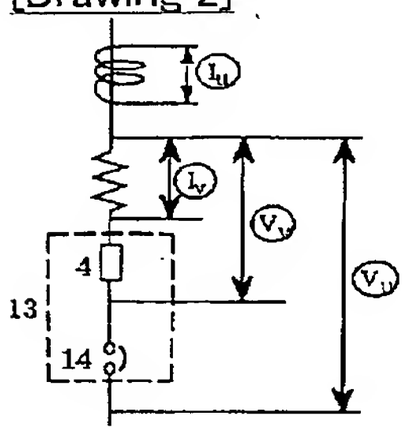
[Translation done.]

DRAWINGS

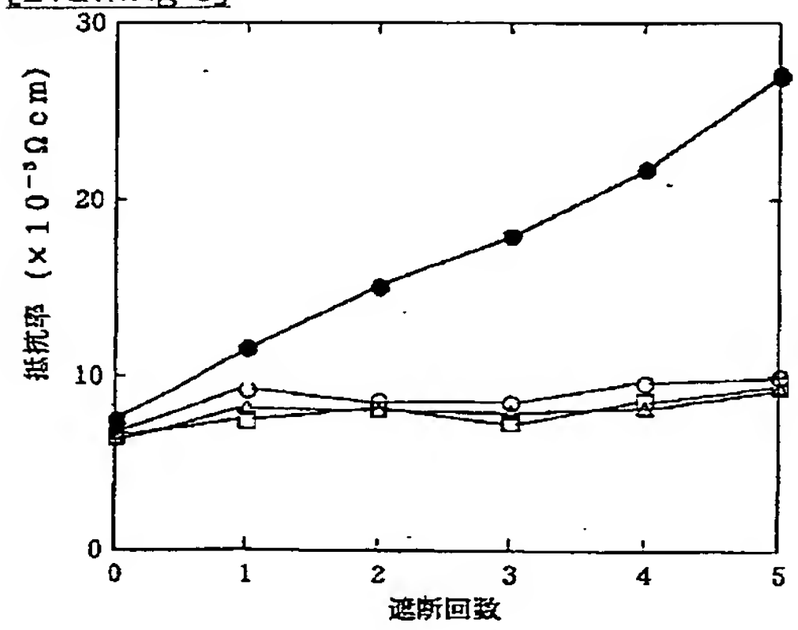
[Drawing 1]



[Drawing 2]



[Drawing 3]



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